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EPA

Taking Toxics Out of the Air

Progress in Setting "Maximum Achievable Control Technology" Standards Under the Clean Air Act

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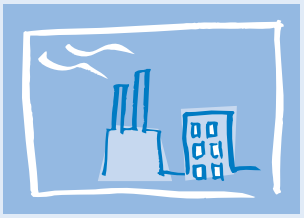
The air we breathe can be contaminated with pollutants from factories, vehicles, power plants, and many other sources. These pollutants have long been a major concern because of the harmful effects they have on peoples' health and the environment. Their impact depends on many factors, including the quantity of air pollution to which people are exposed, the duration of the exposures, and the potency of the pollutants. The effects of air pollutants can be minor and reversible (such as eye irritation) or debilitating (such as aggravation of asthma) and even fatal (such as cancer).

Since 1970, the Clean Air Act has provided the primary framework for protecting people and the environment from the harmful effects of air pollution. A key component of the Clean Air Act is a requirement that the U.S. Environmental Protection Agency (EPA) significantly reduce daily, so-called "routine" emissions of the most potent air pollutants: those that are known or suspected to cause serious health problems such as cancer or birth defects. The Clean Air Act refers to these pollutants as "**hazardous air pollutants**," but they are also commonly known as **toxic air pollutants** or, simply, **air toxics**.

Prior to 1990, the Clean Air Act required EPA to set standards for each toxic air pollutant individually, based on its particular health risks. This approach proved difficult and minimally effective at reducing emissions. As a result, when amending the Clean Air Act in 1990, Congress directed EPA to use a "technology-based" and performance-based approach to significantly reduce emissions of air toxics from major sources of air pollution, followed by a risk-based approach to address any remaining, or residual, risks.

The technology- and performance-based standards issued by EPA over the past 6 years have proven extremely successful. Once fully implemented, these standards will cut emissions of toxic air pollutants by nearly 1 million tons per year—almost 10 times greater reductions than EPA was able to achieve in 20 years under the pre-1990 approach.

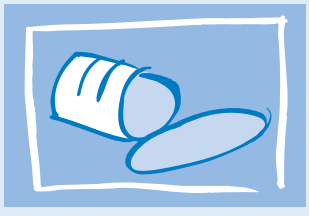
Sources of Air Toxics



Routine Emissions From Stationary Sources

Mobile Sources

Volcanoes



Accidental Releases

Each year, millions of tons of toxic pollutants are released into the air from both natural and manmade sources.

Forest Fires

Mobile Sources and Accidental Releases

While this document focuses on EPA's efforts to reduce routine emissions from stationary sources, EPA also is working to reduce toxic emissions from:

- **Mobile sources**, such as cars and trucks. For example, EPA and state governments (e.g., California) have reduced emissions of benzene, toluene, and other toxic pollutants from mobile sources by requiring the use of reformulated gasoline and placing limits on tailpipe emissions. For more information, contact EPA's Office of Mobile Sources at www.epa.gov/OMSWWW/toxics.htm or call (202) 260-7400.
- **Accidental releases**, including leaks and spills. For example, EPA has established regulations under the Clean Air Act requiring certain facilities to implement risk management programs that will help prevent accidental releases of toxic chemicals. For more information, contact EPA's Office of Chemical Emergency Preparedness and Prevention at www.epa.gov/swercepp or call (800) 424-9346.

Under the "technology-based" approach, EPA develops standards for controlling the "routine" emissions of air toxics from each major type of facility within an industry group (or "source category"). These standards—known as "maximum achievable control technology (MACT) standards"—are based on emissions levels that are already being achieved by the better-controlled and lower-emitting sources in an industry. This approach assures citizens nationwide that each major source of toxic air pollution will be required to employ effective measures to limit its emissions. Also, this approach provides a level economic playing field by ensuring that facilities that employ cleaner processes and good emission controls are not disadvantaged relative to competitors with poorer controls.

In setting MACT standards, EPA does not generally prescribe a specific control technology. Instead, whenever feasible, the Agency sets a performance level based on technology or other practices already used by the industry. Facilities are free to achieve these performance levels in whatever way is most cost-effective for them. The MACT standards issued by EPA over the past 6 years have proven extremely successful. Once fully implemented, these standards will cut emissions of toxic air pollutants by nearly 1 million tons per year.

Eight years after each MACT standard is issued, EPA must assess the remaining health risks from source categories. If necessary, EPA may implement additional standards that address any significant remaining risk.

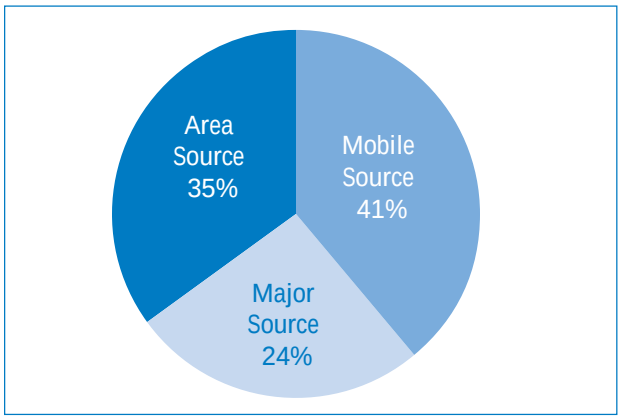
This document describes what air toxics are, where they come from, and how they can impact people and the environment. It also describes the individual standards EPA has issued to reduce emissions of air toxics from industries such as chemical manufacturing, petroleum refining, and steel manufacturing. Additional information on air toxics and EPA's air toxics programs can be found on the Internet at www.epa.gov/ttn/uatw.

What Are Toxic Air Pollutants?

Toxic (also called hazardous) air pollutants are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or to cause adverse environmental effects. The degree to which a toxic air pollutant affects a person's health depends on many factors, including the quantity of pollutant the person is exposed to, the duration and frequency of

exposures, the toxicity of the chemical, and the person's state of health and susceptibility.

The 1990 Clean Air Act Amendments list 188 toxic air pollutants that EPA is required to control.[1] Examples of toxic air pollutants include benzene, which is found in gasoline; perchloroethylene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries. Examples of other listed air toxics include dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds.



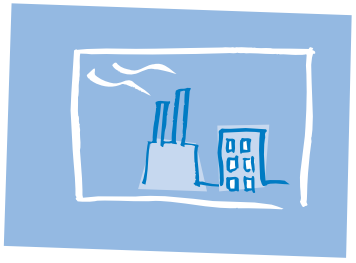
Based on 1993 emission inventory data, major sources account for about 24 percent of air toxics emissions, area sources for 35 percent, and mobile sources for 41 percent. Accidental releases and natural sources, which also contribute air toxics to the atmosphere, are not included in these estimates.

Where Do Air Toxics Come From?

Scientists estimate that millions of tons of toxic pollutants are released into the air each year. Some air toxics are released from natural sources such as volcanic eruptions and forest fires. Most, however, originate from manmade sources, including both mobile sources (e.g., cars, buses, trucks) and stationary sources (e.g., factories, refineries, power plants). This document focuses on EPA's efforts, as of January 1998, to reduce *routine* (as opposed to accidental) emissions of toxic air pollutants from stationary sources. Routine emissions from stationary sources constitute almost two-thirds of all manmade air toxics emissions.

There are two types of stationary sources that generate routine emissions of air toxics:

- **"Major" sources** are defined as sources that emit 10 tons per year of any of the listed toxic air pollutants, or 25 tons per year of a mixture of air toxics. Examples include chemical plants, steel mills, oil refineries, and hazardous waste incinerators. These sources may release air toxics from equipment leaks, when materials are transferred from one location to another, or during discharge through emissions stacks or vents. One key public health concern regarding major sources is the health effects on populations located downwind from them.



- **"Area" sources** consist of smaller sources, each releasing smaller amounts of toxic pollutants into the air. Area sources are defined as sources that emit less than 10 tons per year of a single air toxic, or less than 25 tons per year of a combination of air toxics. Examples include neighborhood dry cleaners and gas stations. Though emissions from individual area sources are often relatively small, collectively their emissions can be of concern—particularly where large numbers of sources are located in heavily populated areas.

[1] The list originally included 189 chemicals. Based on new scientific information, EPA removed caprolactam from the list in 1996; thus, the current list includes 188 pollutants.

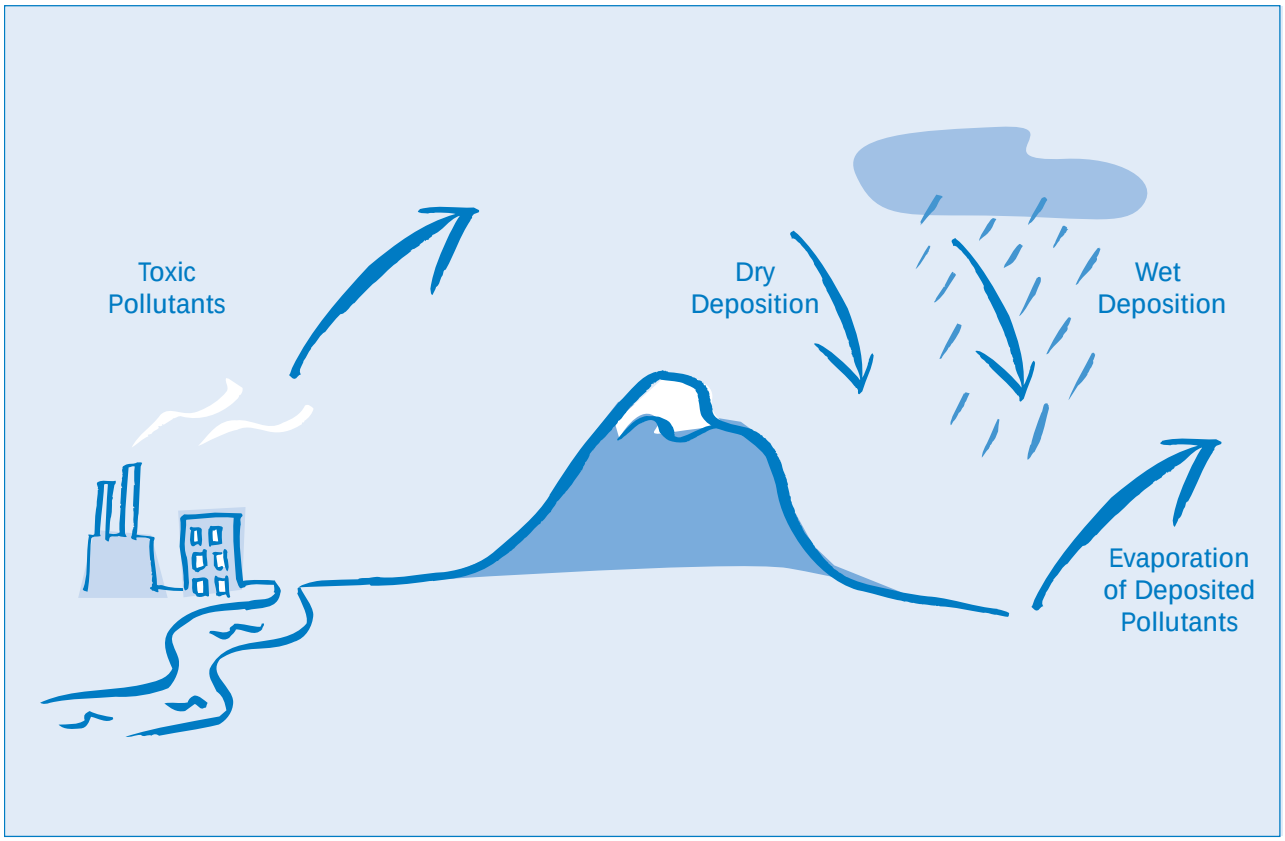
EPA's published list now contains 175 categories of industrial and commercial sources that emit one or more toxic air pollutants. For each of these "source categories," EPA indicated whether the sources are considered to be "major" sources or "area" sources. The 1990 Clean Air Act Amendments direct EPA to set standards requiring all major sources of air toxics (and some area sources that are of particular concern) to significantly reduce their air toxics emissions.

Where Do Air Toxics Go?

Once released, toxic pollutants can be carried by the wind, away from their sources, to other locations. Factors such as weather, the terrain (i.e., mountains, plains, valleys), and the chemical and physical properties of a pollutant determine how far it is transported, its concentration at various distances from the source, what kind of physical and chemical changes it undergoes, and whether it will degrade, remain airborne, or deposit to land or water.

Some pollutants remain airborne and contribute to air pollution problems far from the pollution source. Other pollutants released into the air can be deposited to land and water bodies through precipitation, or by settling directly out of the air onto land or water. Eventually, a large portion of those pollutants deposited near water bodies or small tributaries will reach the water bodies via stormwater runoff or inflow from the tributary streams.

Some toxic air pollutants are of particular concern because they degrade very slowly or not at all, as in the case of metals such as mercury or lead. These persistent air toxics (as they are called) can remain in the environment for a long time (or forever, in the case of metals) and can be transported great distances.



Toxic air pollutants can be deposited to land and water bodies through precipitation (wet deposition) or by settling directly out of the air (dry deposition). Repeated cycles of transport, deposition, and evaporation can move toxic air pollutants very long distances.

Often, persistent air toxics reach the ground, evaporate back into the atmosphere, and are then transported further until they are deposited on the ground again. Repeated cycles of transport, deposition, and evaporation can move toxic air pollutants very long distances. For example, toxic pollutants such as toxaphene, a pesticide used primarily in the cotton belt, have been found in the Antarctic, thousands of miles from their likely emissions sources.

How Are People Exposed to Air Toxics?

People are exposed to toxic air pollutants in many ways that can pose health risks, such as by:

- Breathing contaminated air.
- Ingesting contaminated food products—such as fish from contaminated waters; meat, milk, or eggs from animals that fed on contaminated plants; and fruits and vegetables grown in contaminated soil on which air toxics have been deposited.
- Ingesting contaminated water. Some people may be exposed to toxic air pollutants by drinking contaminated water.
- Ingesting contaminated soil. Young children also may be exposed by ingesting contaminated soil from their hands, food, or objects they place in their mouths.
- Touching (skin contact) contaminated soil, dust, or water (for example, during recreational use of contaminated water bodies).

Once ingested, some of the more persistent toxic air pollutants accumulate in body tissues. Also, through a phenomenon called **biomagnification**, predators typically accumulate even greater pollutant concentrations than their contaminated prey. As a result, people and other animals at the "top" of the food chain who eat contaminated fish or meat are exposed to concentrations that are much higher than the concentrations in the water, air, or soil.

Fish consumption advisories have been issued for thousands of water bodies nationwide, including the Great Lakes, Lake Champlain, the Potomac River, and Chesapeake Bay. Thirty-nine states currently have consumption advisories for specific water bodies, warning consumers about mercury-contaminated fish and shellfish. Ten of those states have advisories on every inland water body. Many of these advisories have been issued for water bodies that were once thought to be relatively pristine, where deposition from the atmosphere is thought to be a major source of the pollution.

Health Effects

People who are exposed to toxic air pollutants at sufficient concentrations and for sufficient durations may increase their chances of getting cancer or experiencing other serious health effects. Depending on which air toxics an individual is exposed to, these health effects can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, and respiratory problems. A growing body of evidence indicates that some air toxics (e.g., DDT, dioxins, and mercury) may disturb hormonal (or endocrine) systems. In some cases this happens by pollutants either mimicking or blocking hormones. Health effects associated with endocrine disruption include reduced fertility, birth defects, and breast cancer.

How Do Air Toxics Affect the Environment?

Toxic pollutants in the air, or deposited on soils or surface waters, can have a number of environmental impacts. Like humans, animals can experience health problems if they are exposed to sufficient concentrations of air toxics over time. Numerous studies conclude that deposited air toxics are contributing to

birth defects, reproductive failure, and disease in animals. Persistent toxic air pollutants are of particular concern in aquatic ecosystems because the pollutants accumulate in sediments and may biomagnify in tissues of animals at the top of the food chain to concentrations many times higher than in the water or air.

Toxic pollutants that mimic hormones also pose a threat to the environment. In some wildlife (e.g., birds, shellfish, fish, and mammals), exposures to pollutants such as DDT, dioxins, and mercury have been associated with decreased fertility, decreased hatching success, damaged reproductive organs, and altered immune systems.

What Has EPA Done to Reduce Air Toxics?

The Pre-1990 "Risk-Only" Approach

Prior to 1990, the Clean Air Act directed EPA to regulate toxic air pollutants based on the risks each pollutant posed to human health. Specifically, the Act directed EPA to:

- Identify all pollutants that caused "serious and irreversible illness or death."
- Develop standards to reduce emissions of these pollutants to levels that provided an "ample margin of safety" for the public.

While attempting to control air toxics during the 1970s and 1980s, EPA became involved in many legal, scientific, and policy debates over which pollutants to regulate and how stringently to regulate them. Debates focused on risk assessment methods and assumptions, the amount of health risk data needed to justify regulation, analyses of the costs to industry and benefits to human health and the environment, and decisions about "how safe is safe."

During this time, EPA lacked adequate methods to assess risk and lacked adequate health and environmental criteria to establish a solid foundation for risk-based decision-making on the multitude of air toxics emitted throughout the United States. Many regulators, as well as many members of the communities to be regulated, were reluctant to accept risk assessment as a legitimate policy tool. During this period, EPA and the scientific community gained valuable knowledge about risk assessment methods. However, the chemical-by-chemical regulatory approach—an approach based solely on risk—proved difficult, and in 20 years EPA regulated only seven pollutants (asbestos, benzene, beryllium, inorganic arsenic, mercury, radionuclides, and vinyl chloride). Collectively, these standards only cut annual air toxics emissions by an estimated 125,000 tons.

The 1990 Clean Air Act Amendments: A "Technology First, Then Risk" Approach

Realizing the limitations of a chemical-by-chemical decision framework based solely on risk, and acknowledging the gaps in scientific and analytical information, Congress adopted a new strategy in 1990, when the Clean Air Act was amended. Specifically, Congress revised Section 112 of the Clean Air Act to mandate a more practical approach to reducing emissions of toxic air pollutants.

This approach has two components. In the first phase, EPA develops regulations—MACT standards—requiring sources to meet specific emissions limits that are based on emissions levels already being achieved by many similar sources in the country. Even in its earliest stages, this new "technology-based" approach has clearly produced real, measurable reductions. In the second phase, EPA applies a risk-based approach to assess how these technology-based emissions limits are reducing health and environmental risks. Based on this assessment, EPA may implement additional standards to address any significant remaining, or residual, health or environmental risks. EPA is currently developing a strategy for addressing residual risks from air toxics.

Maximum Achievable Control Technology—MACT

EPA's MACT standards are based on the emissions levels already achieved by the best-performing similar facilities. This straight-forward, performance-based approach yields standards that are both reasonable and effective in reducing toxic emissions. This approach also provides a level economic playing field by ensuring that facilities with good controls are not disadvantaged relative to competitors with poorer controls.

When developing a MACT standard for a particular source category, EPA looks at the level of emissions currently being achieved by the best-performing similar sources through clean processes, control devices, work practices, or other methods. These emissions levels set a baseline (often referred to as the "MACT floor") for the new standard. At a minimum, a MACT standard must achieve, throughout the industry, a level of emissions control that is at least equivalent to the MACT floor. EPA can establish a more stringent standard when this makes economic, environmental, and public health sense.

The MACT floor is established differently for existing sources and new sources:

- For **existing sources**, the MACT floor must equal the average emissions limitations currently achieved by the best-performing 12 percent of sources in that source category, if there are 30 or more existing sources. If there are fewer than 30 existing sources, then the MACT floor must equal the average emissions limitation achieved by the best-performing five sources in the category.
- For **new sources**, the MACT floor must equal the level of emissions control currently achieved by the best-controlled similar source.

Wherever feasible, EPA writes the final MACT standard as an emissions limit (i.e., as a percent reduction in emissions or a concentration limit that regulated sources must achieve). Emissions limits provide flexibility for industry to determine the most effective way to comply with the standard.

What Progress Has Been Made in Reducing Toxic Air Pollution?

As of January 1998, EPA has issued 23 air toxics MACT standards under Section 112 of the Clean Air Act Amendments. These standards affect 48 categories of major industrial sources, such as chemical plants, oil refineries, aerospace manufacturers, and steel mills, as well as eight categories of smaller sources, such as dry cleaners, commercial sterilizers, secondary lead smelters, and chromium electroplating facilities. EPA has also issued two standards under Section 129 of the Clean Air Act to control emissions, including certain toxic pollutants, from solid waste combustion facilities (one standard for municipal waste combustors and the other for medical waste incinerators). Together, these standards reduce emissions of over 100 different air toxics. When fully implemented, these standards will reduce air toxics emissions by about 1 million tons per year—almost 10 times greater reductions than were achieved under all the pre-1990 standards. Each of the final rules developed since 1990 is summarized as an appendix to this document (pages 10 to 22). These summaries describe the sources for which final rules have been issued, the types of pollutants the sources emit, and how EPA's rules are reducing their emissions.

Some of these air toxics rules have the added benefit of reducing ground-level ozone (urban smog) and particulate matter. This occurs because some air toxics are also smog-causing volatile organic compounds (VOCs) (e.g., toluene) or particulate matter (e.g., chromium). In addition, some of the technologies and practices designed to control air toxics also reduce VOCs or types of particulate matter that are not currently among the 188 listed air toxics. Reductions of smog-causing pollutants and particulate matter are important because of the health and environmental problems they can cause. Most notably, urban smog can cause respiratory problems and can damage vegetation, and particulate matter can cause many detrimental impacts on human health, such as bronchitis, lung damage, increased infection, aggravation of asthma, and premature death. In addition many of these pollutants can contribute significantly to impaired visibility in places, such as national parks, that are valued for their scenic views and recreational opportunities.

EPA has consistently worked to develop air toxics standards that achieve the required reductions in air pollution while providing regulated communities with as much flexibility as possible in deciding how to comply with the standards. For example, under a flexible regulation, industries may reduce their emissions by redesigning their processes, capturing and recycling emissions, changing work practices, or installing any of a variety of control technologies. Flexibility helps industries minimize the cost of compliance and encourages pollution prevention. To provide flexibility, EPA makes every effort to develop standards that are based on performance measures rather than specific control devices, and that allow for equivalent alternative control measures.

Looking Ahead

EPA has focused most of its initial air toxics control efforts under the 1990 Clean Air Act Amendments on reducing emissions by setting technology-based standards. In addition to the 23 final air toxics MACT standards, EPA has also proposed a number of other rules covering 22 source categories, such as polyurethane foam production, wool fiberglass operations, and phosphoric acid/phosphate fertilizer production.

Over the next several years, EPA will continue to work with industry and others to develop standards for all remaining source categories to reduce air toxics emissions even further. The Agency expects to complete a number of standards—such as agricultural chemical production and pharmaceuticals manufacturing—by the end of 1998, and dozens of other standards by the year 2000. Under the Clean Air Act Amendments, existing regulated facilities generally have up to 3 years from the date a MACT standard is finalized to come into compliance with that standard's requirements. New sources must be in compliance upon start-up. Within the next 10 years, as these additional standards are implemented, emissions of toxic air pollutants are expected to be reduced by about 75 percent from 1990 levels.

The Next Steps

EPA anticipates that its technology-based approach will continue to prove extremely successful at reducing air toxics. Other air toxics reductions are also expected to continue as a result of mobile and other stationary source control programs (e.g., implementation of new particulate and ozone national ambient air quality standards) that indirectly reduce toxics. At the same time, however, the Agency recognizes the need for continued research into the dangers posed by air toxics.

The 1990 Clean Air Act Amendments call for EPA to supplement its technology-based approach by assessing the effectiveness of the MACT standards at reducing the health and environmental risks posed by air toxics. Based on this assessment, the Agency may implement additional standards that address any

significant remaining, or residual, risk. After setting a MACT standard, EPA has 8 years (9 years for the earliest standards) to examine the risk posed by continued emissions from regulated facilities and to issue requirements for additional controls if they are necessary to reduce an unacceptable residual risk. Currently, EPA is working with industry representatives, states, and others to develop a residual risk program, and is collecting the necessary data to conduct the first risk assessments, beginning in 1998.

In addition to the residual risk assessments of MACT standards, the Clean Air Act Amendments also require EPA to conduct special studies to assess whether certain air toxics problems may not be fully addressed by the MACT and residual risk programs. Since 1990, EPA has published two reports on deposition of air toxics and their detrimental effects on the Great Lakes, Chesapeake Bay, Lake Champlain, and coastal waters. In these reports, EPA listed 15 pollutants of greatest concern that have a tendency to persist in the environment and accumulate. The pollutants of concern are: metals (mercury, cadmium, lead), dioxins, furans, polycyclic organic matter, polychlorinated biphenyls (PCBs), pesticides (such as chlordane and DDT/DDE), and nitrogen compounds. EPA is continuing to develop and implement strategies under the Clean Air Act Amendments to reduce releases of these pollutants. The Agency is expected to issue subsequent reports every 2 years, outlining any control measures needed to achieve further reductions in toxic pollutants that are being deposited in water bodies.

EPA is also studying air toxics emitted from coal-, oil-, and gas-fired electric utility power generation plants and the health hazards associated with these emissions. Preliminary information indicates that emissions of toxic pollutants from coal-fired power plants are expected to increase by 30 percent over the next 2 decades, while emissions from oil-fired power plants are expected to decline by 50 percent. Utility plants (primarily coal-fired plants) emit approximately 51 tons per year of mercury nationwide, which is roughly 32 percent of the manmade mercury emissions in the United States. This study is intended to determine if emissions of toxic air pollutants from power plants should be controlled under Section 112 of the Clean Air Act because of health risk concerns. EPA plans to publish a final report in 1998.

The Clean Air Act Amendments also require EPA to develop an urban strategy that will reduce air toxic emissions from area sources to address the associated health risk problems posed by the most highly toxic pollutants (at least 30 of them). In addition, the Amendments require that EPA study the need for and feasibility of controlling emissions of toxic pollutants from motor vehicles and fuels. EPA is looking at an integrated approach that addresses the urban air toxic emissions from both stationary sources and mobile sources. EPA is currently analyzing data to determine which air toxics sources will be included in the urban air toxics program, which is expected to be completed by the end of 1998.

For Further Information

For further information on EPA's air toxics program and other activities under the Clean Air Act Amendments, contact the following Web sites and EPA offices:

Unified Air Toxics Website
Internet: www.epa.gov/ttn/uatw

EPA Office of Air and Radiation
Internet: www.epa.gov/oar/
(202) 260-7400

EPA Office of Mobile Sources
Internet: www.epa.gov/OMSWWW/omshome.htm

EPA Office of Chemical Emergency Preparedness and Prevention
Internet: www.epa.gov/swercepp
(800) 424-9346

Summaries of EPA's Final Air Toxics MACT Rules

The following summaries describe 23 air toxics rules EPA has issued since 1990 under Section 112 of the Clean Air Act.

DRY CLEANERS

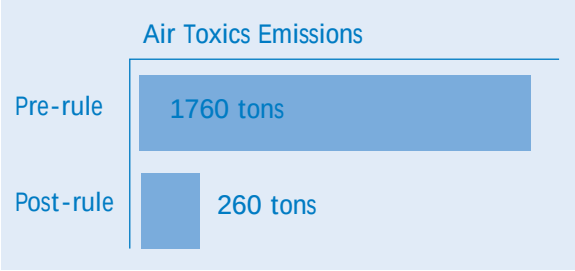
Final rule published September 22, 1993

- Dry cleaning facilities are the largest source of perchloroethylene (also called perc) emissions in the United States. Because dry cleaners are located in many communities across the country, perc emissions from dry cleaners are often released in close proximity to large numbers of people.
- Perc can cause dizziness, nausea, and headaches and is suspected to cause cancer in humans.
- EPA's rule requires all dry cleaners that use perc to implement pollution prevention measures. It also contains specific control requirements that vary depending on the type of machinery and the amount of perc a facility uses.
- The rule affects approximately 30,000 dry cleaners and will reduce perc emissions at these facilities by about 7,300 tons per year.

COKE OVEN BATTERIES AT STEEL PLANTS

Final rule published October 27, 1993

- Coke oven batteries (a group of ovens connected by common walls) are used to convert coal into coke, which is then used in blast furnaces to convert iron ore to iron.
- Coke oven emissions contain benzene (a known carcinogen) and other chemicals that can cause cancer of the respiratory tract, kidney, and prostate. Long-term exposure to coke oven emissions can also cause conjunctivitis, severe dermatitis, and lesions of the respiratory and digestive systems.
- EPA's rule provides guidelines for day-to-day operations and sets emissions limits for existing sources and even tighter limits for new sources. The rule was developed through a formal regulatory negotiation process that involved extensive industry participation. It provides industry with a menu of compliance options—this flexibility should significantly reduce compliance costs.
- The coke oven rule affects 29 existing facilities and will reduce air toxics by approximately 1,500 tons per year.



ORGANIC CHEMICAL PRODUCTION PLANTS

Final rule published April 22, 1994

- EPA's rule reduces emissions of 131 organic air toxics from chemical manufacturing processes in the Synthetic Organic Chemical Manufacturing Industry and from several other chemical production processes. The rule applies to production of about 385 chemicals.
- The rule requires reductions in toxic organic air pollutants emitted from process vents, storage vessels, transfer racks, equipment leaks, and wastewater treatment systems.
- Emissions averaging is allowed in the rule as a compliance option to give industry flexibility in meeting the emissions reduction limits.
- The rule affects an estimated 310 facilities and will reduce air toxics emissions by 510,000 tons per year—a 90 percent reduction from the preregulated levels emitted by these facilities. The rule will also reduce VOCs by about 1 million tons per year—an 80 percent reduction from the preregulated levels emitted by these facilities, and equivalent to taking approximately 38 million cars off the road.

INDUSTRIAL PROCESS COOLING TOWERS

Final rule published September 8, 1994

- Industrial process cooling towers are used to remove heat from industrial processes. In the past, chromium was added to cooling tower waters to prevent equipment corrosion and control algae growth.
- Chromium (Chromium VI, the most toxic form, is known to cause lung cancer) is ultimately released from the cooling towers into the air. Most individual industrial process cooling towers do not qualify as major sources of air toxics; however, almost all cooling towers are part of large production facilities (e.g., petroleum refineries, chemical manufacturing plants, and primary metal producers) that do qualify.
- EPA's rule prohibits the use of chromium-based water treatment chemicals and suggests that facilities substitute phosphate-based chemicals.
- The rule affects an estimated 800 cooling towers at about 400 major sources nationwide and will reduce chromium emissions by 25 tons per year—a 100 percent reduction from the preregulated levels emitted by these facilities.

HALOGENATED SOLVENT CLEANING MACHINES

Final rule published December 2, 1994

- Halogenated solvent cleaning machines (also known as degreasers) are used to clean oil and residues in the manufacturing and assembly of metal parts. Halogenated solvent cleaning is not a distinct industry, but it is an integral part of many industries, such as the aerospace and motor vehicle manufacturing industries. There are three basic types of solvent cleaning equipment:
  - Batch vapor cleaners, which heat the solvent to create a solvent vapor zone within which the parts are cleaned.
  - In-line cleaners, which are enclosed devices distinguished by a conveyor system used to supply a continuous stream of parts for cleaning.
  - Batch cold cleaners, which use liquid solvent to remove soils from part surfaces.
- Numerous air toxics contained in these solvent mixtures are released during the cleaning process.
- The rule applies to cleaning machines that use methylene chloride, perchloroethylene, trichloroethylene, 1,1,1-trichloroethane, carbon tetrachloride, chloroform, or any combination of these solvents in a total concentration that is greater than 5 percent by weight.
- EPA's rule combines equipment and work practice standards that emphasize pollution prevention. As an alternative to complying with the equipment standards option, facilities using batch vapor or in-line cleaning machines may demonstrate that each solvent cleaning machine emits less than an overall solvent emissions limit.
- The rule affects an estimated 9,000 facilities that use solvent cleaning machines and will reduce air toxics emissions at these facilities by 85,300 tons per year and VOC emissions by 81,700 tons per year.

COMMERCIAL STERILIZATION AND FUMIGATION OPERATIONS

Final rule published December 6, 1994

- A number of industries (including medical equipment suppliers; pharmaceutical companies; cosmetics manufacturers; spice manufacturers; libraries, museums, and archives; and contact sterilizers) use ethylene oxide as a sterilant for heat- or moisture-sensitive materials or as a fumigant to control microorganisms or insects.
- Ethylene oxide (a probable human carcinogen that also can cause adverse reproductive and developmental effects) is released during these operations.
- EPA's rule sets ethylene oxide emissions limits for sterilization chamber vents, chamber exhaust vents, and aeration rooms.
- The rule affects an estimated 114 sources and will reduce ethylene oxide emissions by about 1,000 tons per year—a 94 percent reduction from the preregulated levels emitted by these sources.

GASOLINE DISTRIBUTION FACILITIES

Final rule published December 14, 1994

- The gasoline distribution standard regulates bulk terminals and pipeline breakout stations, which transfer and store gasoline as it goes from petroleum refineries to service stations and gasoline bulk plants.
- Approximately 10 toxic air pollutants, including benzene and toluene, are present in gasoline vapor. These pollutants are released from gasoline distribution facilities during tank truck and rail car loading operations, gasoline storage, and equipment leaks.
- EPA's rule requires the use of pollution prevention methods (such as improving seals on storage tanks and inspecting equipment for leaks) and the use of controls (such as vapor processors to collect and treat gas vapors displaced during cargo tank loading operations).
- The rule affects an estimated 240 gasoline bulk terminals and 20 pipeline breakout stations. It will reduce air toxics emissions from these facilities by 2,300 tons per year and VOC emissions by over 38,000 tons per year. In addition, the collection and/or prevention of gasoline evaporation under the final rule is expected to result in energy savings of an estimated 10 million gallons of gasoline per year.

MAGNETIC TAPE MANUFACTURING

Final rule published December 15, 1994

- Magnetic tape manufacturers make products such as audio and video cassettes and computer diskettes.
- Toxic air pollutants are released when solvent mixtures are used during coating and equipment cleaning operations. In addition, particulate air toxics may be released when magnetic particles are transferred to the coating mixture.
- EPA's rule requires 95 percent control for most types of emission points, including the coating operations. For many of these emission points, EPA has developed alternative emissions standards, such as one that allows facilities the flexibility to commit to more stringent control of their coating operations in lieu of controlling certain storage tanks.
- The rule affects an estimated 14 of the 25 facilities that manufacture magnetic tape. It will reduce emissions of air toxics, most of which are VOCs, by 2,300 tons per year.

CHROMIUM ELECTROPLATING AND ANODIZING OPERATIONS

Final rule published January 25, 1995

- Chromium electroplating and anodizing operations coat metal parts and tools with a thin layer of chromium to protect them from corrosion and wear. Examples of electroplated parts include appliances, automotive parts, and large cylinders used in construction equipment and printing presses. Anodized parts include miscellaneous aircraft components such as wings and landing gears.
- Chromium VI (known to cause lung cancer) is released during the electroplating and anodizing processes.
- EPA's rule sets specific emissions limits for new and existing chromium electroplating and anodizing operations that fall into specific size categories. The rule requires facilities to meet emissions limits through the use of pollution prevention practices and controls.
- The rule affects an estimated 1,500 hard chromium electroplating facilities, 2,800 decorative chromium electroplating facilities, and 700 chromium anodizing facilities. It will reduce chromium emissions by 173 tons per year—a 99 percent reduction from the preregulated levels emitted by these facilities.

BASIC LIQUID EPOXY RESINS AND NON-NYLON POLYAMIDE RESINS MANUFACTURE

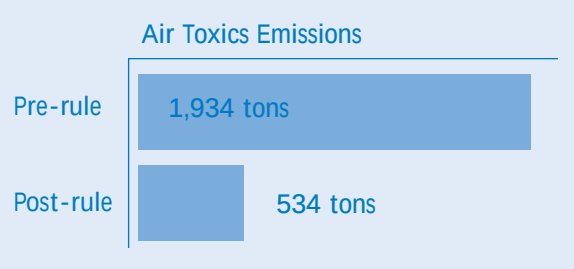
Final rule published March 8, 1995

- Basic liquid epoxy resins are used in the production of glues, adhesives, plastic parts, and surface coatings. Non-nylon polyamide or wet strength resins are used to improve the strength of paper.
- Epichlorohydrin (strongly suspected of causing cancer and known to cause respiratory problems) is released during the resin manufacturing process.
- EPA's rule is based on an epichlorohydrin emissions limit, which provides facilities with the flexibility to meet the regulation's requirements with a variety of compliance options. The rule also requires facilities to implement leak detection and repair programs.
- The rule affects all three basic liquid epoxy resins manufacturing facilities and all nine non-nylon polyamide manufacturing facilities. It will reduce epichlorohydrin emissions by 110 tons per year.

SECONDARY LEAD SMELTER INDUSTRY

Final rule published June 23, 1995

- Secondary lead smelters produce lead from scrap and provide the primary means for recycling lead-acid automotive batteries. The basic operations performed at these facilities include battery breaking, smelting, refining and alloying.
- Secondary lead smelter facilities emit a number of toxic air pollutants, including 1,3-butadiene (a known human carcinogen) and lead compounds.
- EPA's rule requires facilities to reduce emissions from a number of sources, including smelting furnaces, kettles, dryers, and fugitive sources such as material handling.
- The rule affects all 23 secondary lead smelters in the United States. It will reduce emissions of air toxics from these facilities by 1,400 tons per year—a 72 percent reduction from the preregulated levels emitted by these facilities. In addition, the rule is expected to reduce emissions of particulate matter (which can cause serious respiratory problems) from these facilities by 150 tons per year, and carbon monoxide (which can cause adverse health effects, including fatigue, nausea, and respiratory problems) by 88,000 tons per year.



PETROLEUM REFINING INDUSTRY

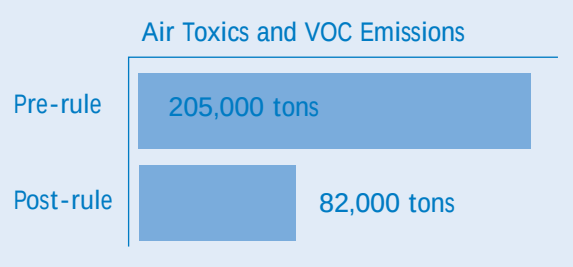
Final rule published August 18, 1995

- Petroleum refineries process crude oil to produce automotive gasoline, diesel fuel, lubricants, and other petroleum-based products.
- Toxic air pollutants, including benzene (a known human carcinogen) and toluene (known to affect the central nervous system and cause developmental problems), are released from storage tanks, equipment leaks, process vents, and wastewater collection and treatment systems at these facilities.
- EPA's rule requires facilities to control emissions from these sources. The rule allows emissions averaging within the petroleum refining facility, and provides additional flexibility by permitting the use of emissions averaging among emission points at petroleum refineries, marine terminal loading operations, and gasoline distribution facilities located at the same site.
- The rule affects all 192 petroleum refineries in the United States and will reduce emissions of 11 air toxics by 53,000 tons per year—a 59 percent reduction from the preregulated levels emitted by these facilities. In addition, the rule is expected to reduce VOC emissions by over 277,000 tons per year—a 60 percent reduction from preregulated levels emitted by these facilities.

AEROSPACE MANUFACTURING AND REWORK INDUSTRY

Final rule published September 1, 1995

- Aerospace manufacturing and rework facilities produce and/or repair aerospace vehicles and vehicle parts, such as airplanes, helicopters, space vehicles, and missiles.
- Toxic air pollutants such as methylene chloride (strongly suspected of causing cancer) and chromium (Chromium VI, the most toxic form, is known to cause lung cancer) are released from these facilities during paint stripping, cleaning, priming, top coat application, and chemical milling maskant operations.
- EPA's rule requires facilities to eliminate most emissions of toxic air pollutants (particularly methylene chloride) from paint stripping operations and to implement controls that will reduce emissions of air toxics resulting from other operations. The final rule provides a variety of options for meeting these requirements.
- The rule is likely to yield substantial cost savings for industry sources by providing industry the flexibility to meet the reductions in the most cost-effective way. For example, the rule contains a market-based emissions averaging provision, which allows facilities to overcontrol some emission points while undercontrolling others.
- The rule affects an estimated 2,800 aerospace manufacturing facilities and will reduce emissions of air toxics and VOCs by 123,000 tons per year—a 60 percent reduction from the preregulated levels emitted by these facilities.



MARINE TANK VESSEL LOADING OPERATIONS

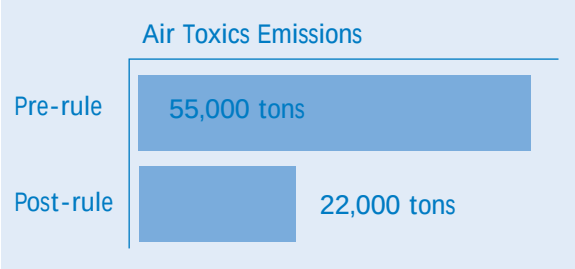
Final rule published September 19, 1995

- Marine tank vessels are used to transport crude oil, gasoline, and toxic chemicals among refineries, bulk terminals, chemical plants, and pipeline terminals.
- These vessels release toxic air pollutants (including benzene, toluene, hexane, xylene, and ethyl benzene) into the air during loading and unloading operations.
- EPA's rule sets limits for both air toxic pollutants and VOCs. It requires large marine loading terminals (i.e., terminals that load either 200 million barrels per year of crude oil, or 10 million barrels per year of gasoline) to reduce emissions of VOCs by 95 percent. It also requires all other major sources to reduce air toxic emissions by 97 percent.
- The rule affects an estimated 30 marine tank vessel loading facilities. It will reduce emissions of air toxics from these facilities by approximately 4,500 tons per year and VOC emissions by approximately 43,000 tons per year.

WOOD FURNITURE MANUFACTURING

Final rule published December 7, 1995

- The wood furniture manufacturing industry includes cabinet shops and facilities that make residential and industrial furniture.
- Toxic air pollutants, including toluene, xylene, methanol, and formaldehyde, are released from these facilities during finishing, gluing, and cleaning operations. These air toxics can cause eye, nose, throat, and skin irritation; damage to the heart, liver, and kidneys; and reproductive effects.
- EPA's rule limits the amount of hazardous air pollutants that can be contained in the coatings used for finishing, gluing, and cleaning operations (substitutes are available that contain lower quantities of hazardous air pollutants). In addition, the rule contains work practice standards such as keeping containers closed, training workers, and periodically inspecting equipment to locate and repair leaks.
- The rule affects an estimated 750 wood furniture manufacturing facilities and will reduce air toxics emissions by 33,000 tons per year—a 60 percent reduction from preregulated levels—and VOC emissions by an additional 8,400 tons per year.



SHIPBUILDING AND SHIP REPAIR INDUSTRY

Final rule published December 15, 1995

- The shipbuilding and repair industry includes shipyards that construct and/or repair commercial or military vessels, such as barges and tankers.
- Toxic air pollutants such as xylene and toluene are released during painting and associated cleaning operations.
- EPA's rule, which is based on pollution prevention measures, requires that containers of paint and cleansers be kept closed, and that facilities use low-VOC coatings for painting and coating operations and handle solvent and paint wastes in a manner that minimizes spills and evaporation. The rule does not apply to major source shipyards that use less than 1,000 liters (approximately 264 gallons) of coatings per year, or to boatyards that only build or repair recreational vessels (marine or freshwater) less than 20 meters (about 66 feet) long.
- The rule affects an estimated 35 shipbuilding and repair facilities and will reduce emissions of air toxics from these facilities by 350 tons per year—a 24 percent reduction from the preregulated levels emitted by these facilities.

PRINTING AND PUBLISHING

Final rule published May 30, 1996

- EPA's rule covers two distinct segments of the printing and publishing industry:
  - Publication rotogravure printers, which produce paper products such as catalogues, magazines, newspaper inserts, and telephone directories.
  - Package-product rotogravure and wide-web flexographic facilities that print on paper, plastic film, metal foil, and vinyl for use in products such as flexible packaging, labels, and gift wrap.
- Toxic air pollutants (including toluene, xylene, methanol, and hexane) are released from the ink systems used by both types of printers.
- For publication rotogravure facilities, EPA's rule limits air toxics emissions to 8 percent of the total amount used (for example, facilities that use only hazardous-air-pollutant-based solvents would be required to recover 92 percent of the air toxics). For package-product rotogravure and wide-web flexographic facilities, the rule requires 95 percent overall control of all organic hazardous air pollutant emissions from their presses.
- EPA's rule incorporates flexible compliance options into its emissions control requirements. Facilities may use pollution prevention methods (which allow printers to eliminate the use of toxic chemicals or to substitute nontoxic chemicals for toxic ones), traditional emissions capture and control equipment, or a combination of the two.
- The rule affects an estimated 27 publication rotogravure facilities and 100 package-product rotogravure and wide-web flexographic facilities. It will reduce air toxics emissions from publication rotogravure printers by about 5,500 tons per year, and those from package-product rotogravure and wide-web flexographic printers by about 2,100 tons per year.

OFF-SITE WASTE OPERATIONS

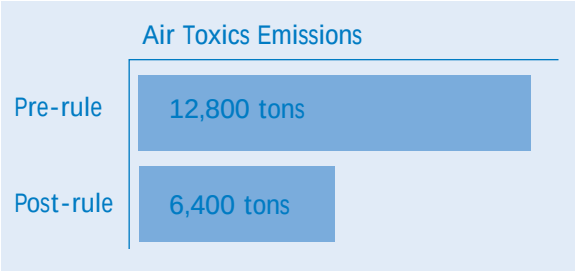
Final rule published July 1, 1996

- Off-site waste facilities include hazardous waste treatment, storage, and disposal facilities; industrial wastewater treatment facilities; solvent recycling facilities; and used-oil recovery facilities that manage hazardous air pollutant-containing materials generated at other facilities.
- A number of toxic air pollutants (including chloroform, toluene, formaldehyde, and xylene) are released from tanks, process vents, equipment leaks, containers, surface impoundments, and transfer systems at these facilities.
- EPA's rule combines equipment, operations, and work practice standards. For example, the rule requires that containers be covered and that process vents meet 95 percent organic emission controls.
- The rule affects an estimated 250 off-site waste operation facilities. It will reduce air toxics emissions by 43,000 tons per year and VOC emissions by 52,000 tons per year.

ELASTOMER PRODUCTION

Final rule published September 5, 1996

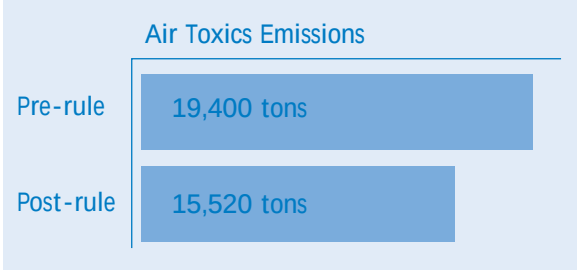
- Elastomers are used in the production of many synthetic rubber products, including tires, hoses, footwear, adhesives, wire insulation, floor tiles, and latexes.
- A number of toxic air pollutants (such as styrene, hexane, and toluene) are released during the initial stages of the elastomer manufacturing process.
- EPA's rule requires that facilities use a pollution prevention technique to reduce the amount of air toxics released during elastomer production. The rule sets emissions limits for several specific emission points—storage tanks, process vents, equipment leaks, and wastewater systems. It also contains a market-based emissions averaging provision that allows facilities to overcontrol some emissions points while undercontrolling others, thus achieving the required reductions in the most cost-effective manner possible.
- The rule affects 36 facilities nationwide and will reduce air toxics emissions by approximately 6,400 tons annually—a 50 percent reduction from current levels.



POLYETHYLENE TEREPHTHALATE POLYMER AND STYRENE-BASED THERMOPLASTIC POLYMERS PRODUCTION

Final rule published September 12, 1996

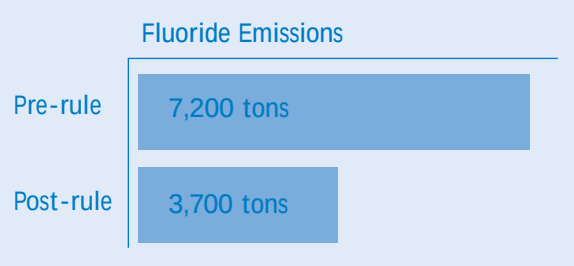
- Polyethylene terephthalate polymers and styrene-based thermoplastics are used in the manufacture of such products as polyester fibers, soft drink bottles, plastic automotive parts, packing materials, and plastic toys.
- A number of toxic pollutants (including styrene, butadiene, and methanol) are released into the air during polymer production.
- To reduce the amount of air toxics released from polymer production facilities, EPA's rule sets emissions limits for several emissions points: storage vessels, process vents, equipment leaks, and wastewater operations. The rule also limits releases from process contact cooling towers at some existing and new facilities.
- EPA developed the rule in partnership with industry representatives and other major stakeholders. The Agency estimates that new facilities will experience annual cost savings of about $5 million under the rule, due to pollution prevention measures.
- The rule affects 66 facilities nationwide and will reduce emissions by approximately 3,880 tons annually—a 20 percent reduction from current levels.

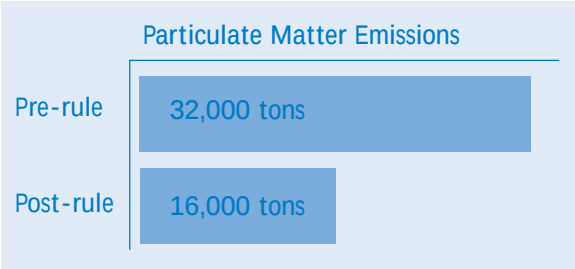


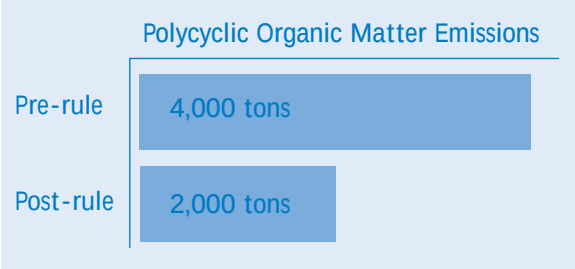
PRIMARY ALUMINUM REDUCTION INDUSTRY

Final rule published October 7, 1997

- Primary aluminum reduction plants produce molten aluminum metal (virgin aluminum) from alumina ore. Typically, primary aluminum plants are components of larger facilities that prepare a variety of finished products. These larger facilities also typically include secondary aluminum plant operations, which use aluminum metal to make products such as cans, aircraft and automotive products, and construction materials. Standards for secondary aluminum production are under development by EPA and are not addressed in this final rule.
- Air toxics released during the production of molten aluminum metal include hydrogen fluoride (which can cause serious respiratory damage) and polycyclic organic matter (which is strongly suspected of causing cancer and other serious health effects).
- Developed in partnership with state regulators, industry stakeholders, and tribal governments, EPA's final rule contains an emissions averaging provision that allows facilities to overcontrol some emissions points while undercontrolling others, thus achieving the required reductions in the most cost-effective manner possible. As a further cost-saving incentive, facilities that consistently perform below the levels set in the standard will be allowed to reduce the frequency of sampling or emissions testing.
- To achieve the required reductions, the final rule relies on a combination of pollution prevention measures, including work practices, equipment modifications, operating practices, housekeeping measures, and in-process recycling.
- The rule affects 24 facilities nationwide. It will reduce fluoride emissions by about 3,700 tons per year, polycyclic organic matter emissions by about 2,000 tons per year, and particulate matter emissions by 16,000 tons per year. These emission levels represent a reduction of approximately 50 percent from preregulated levels.





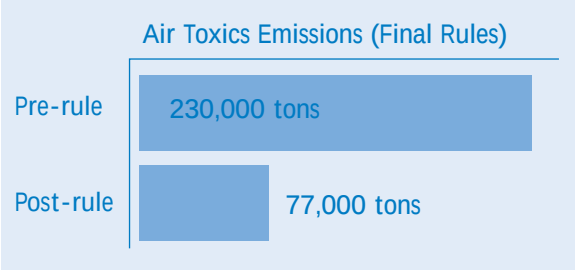


PULP AND PAPER MILLS

Two final rules signed November 14, 1997

- Wood and non-wood fiber sources such as cotton, linen, and straw are turned into pulp either though cooking via chemicals (known as digestion), mechanical grinding, or a combination of both. Following digestion or grinding, the resulting fibrous mass is washed, screened, and (depending on the final product) sometimes bleached.
- A number of toxic air pollutants (including chloroform, chlorine, formaldehyde, methanol, acetaldehyde, methyl ethyl ketone, and metals) are released during cooking, washing, bleaching, and chemical recovery processes at these facilities.

- EPA's air toxics rules are part of an integrated, multimedia regulation designed to control pollutant releases to the water and air. The integrated rules allow the pulp and paper industry to consider all regulatory requirements at one time in order to select the most effective pollution prevention and control technologies.
- EPA has issued two final air toxics standards for the pulp and paper industry that cover emissions from pulping and bleaching processes at mills that chemically pulp wood; papermaking processes at all mills; and pulping and bleaching at non-wood, mechanical, and secondary fiber mills. EPA has also proposed requirements for emissions from the chemical recovery area of chemical wood pulping mills.
- The two final rules will affect approximately 155 mills. These final rules will reduce air toxics emissions by 153,000 tons per year (a 67 percent reduction from preregulated levels at these facilities); VOC emissions by 450,000 tons per year; and total reduced sulfur emissions by 86,000 tons per year. The proposed rule would reduce air toxics emissions by an additional 2,900 tons per year; VOC emissions by 36,000 tons per year; and particulate matter emissions by 26,000 tons per year.



Summaries of Related Solid Waste Incineration Rules

EPA has also issued final rules to control emissions of certain air toxics from solid waste combustion facilities. These rules set emissions limits for new solid waste combustion facilities and provide emissions guidelines for existing solid waste combustion facilities under Section 129 of the Clean Air Act.

MUNICIPAL WASTE COMBUSTORS

Final rule published December 19, 1995; amended August 25, 1997

- Municipal waste combustors include incinerators that burn waste and waste-to-energy plants that generate energy from garbage. EPA's final rule applies to all municipal waste combustion units with the capacity to burn more than 250 tons of garbage per day (known as large municipal waste combustion units; EPA has initiated development of rules for small municipal waste combustion units).
- Municipal waste combustors release a number of pollutants, including cadmium, lead, mercury, dioxin, sulfur dioxide, hydrogen chloride, nitrogen dioxide, and particulate matter. Dioxin and mercury are of particular concern because they are toxic, persist in the environment, and bioaccumulate.
- EPA's rule contains strict standards for new incinerators and sets MACT-based emissions limits for existing incinerators.
- The rule affects an estimated 164 municipal waste combustion units and will significantly reduce air toxics emissions (dioxins, lead, cadmium, and mercury). The rule will reduce dioxin emissions by 99 percent and mercury emissions by 90 percent, compared with 1990 emissions levels from these sources. Overall emissions of other air pollutants (including sulfur dioxide, particulate matter, nitrogen oxides, and hydrogen chloride) will be reduced by more than 90,000 tons per year.

HOSPITAL/MEDICAL/INFECTIOUS WASTE INCINERATORS

Final rule published September 15, 1997

- Hospital, medical, and infectious waste is solid waste produced in the diagnosis, treatment, or immunization of humans or animals; it includes needles, gauzes, boxes, and packaging materials. Fewer than half of all hospitals and a small number of nursing homes, pharmaceutical research laboratories, and veterinary clinics use incinerators to dispose of their waste.
- A number of toxic air pollutants, including dioxins, mercury, lead, and cadmium, are released into the air during the incineration process.
- EPA's rule contains emissions limits for new incinerators and emissions guidelines for existing incinerators. The rule establishes emissions limits for nine pollutants (including dioxin, lead, cadmium, and mercury). It requires training of incinerator operators and establishes requirements for appropriate siting of new incinerators.
- The rule affects an estimated 2,400 existing incinerators and will reduce air toxics emissions (dioxins, lead, cadmium, and mercury) by more than 25 tons per year. Dioxins will be reduced by over 90 percent from the current levels emitted by these incinerators. The rule will also reduce other air pollutant emissions (particulate matter, carbon monoxide, and hydrogen chloride) by over 7,000 tons per year.